Impacts of Climate Change on PNW Hydropower

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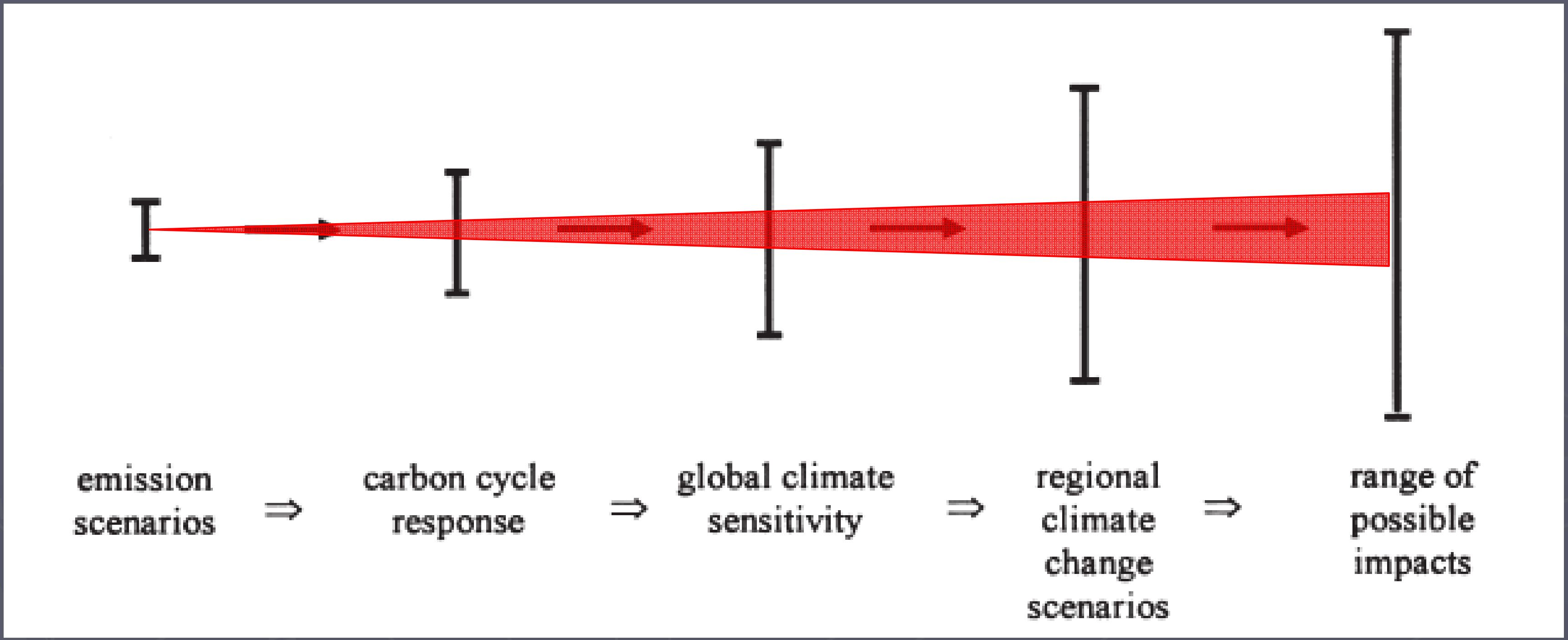
- NWPCC's 5th Plan introduces an economic risk management framework well suited for accommodating uncertainty about the impacts of climate change

- Need to generate set of impact scenarios for the Columbia River Basin

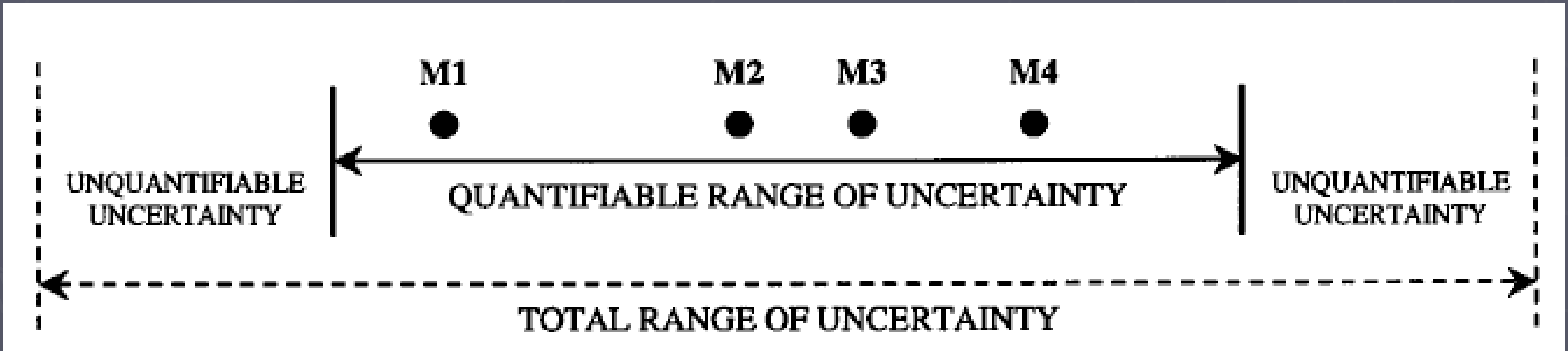
Robust adaptation planning must include comprehensive range of impact scenarios



Cascade of uncertainty showing the major uncertainties common impact assessment. (Figure taken from Schneider and Kuntz-Duriseti, 2002)

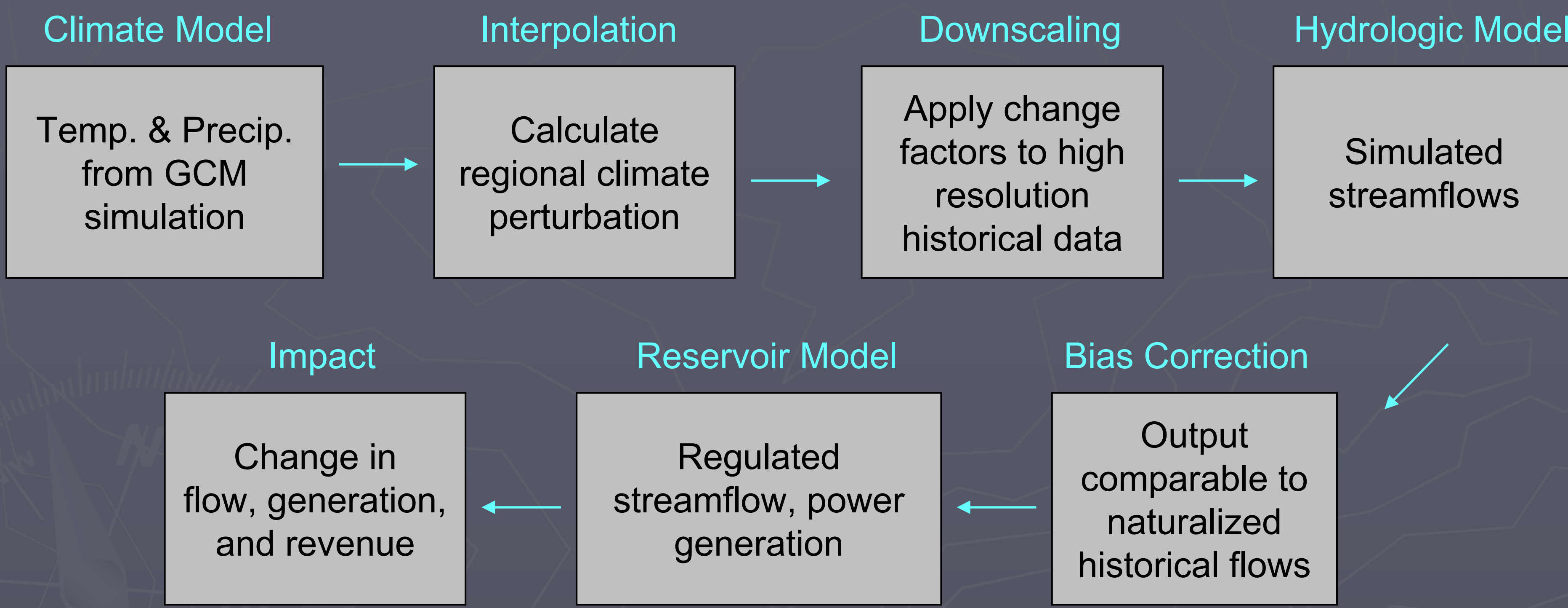
Failure to consider full range of uncertainty at any step may artificially limit the range of impact scenarios used in adaptation planning.

True range of possible outcomes may lie outside the modeled impacts

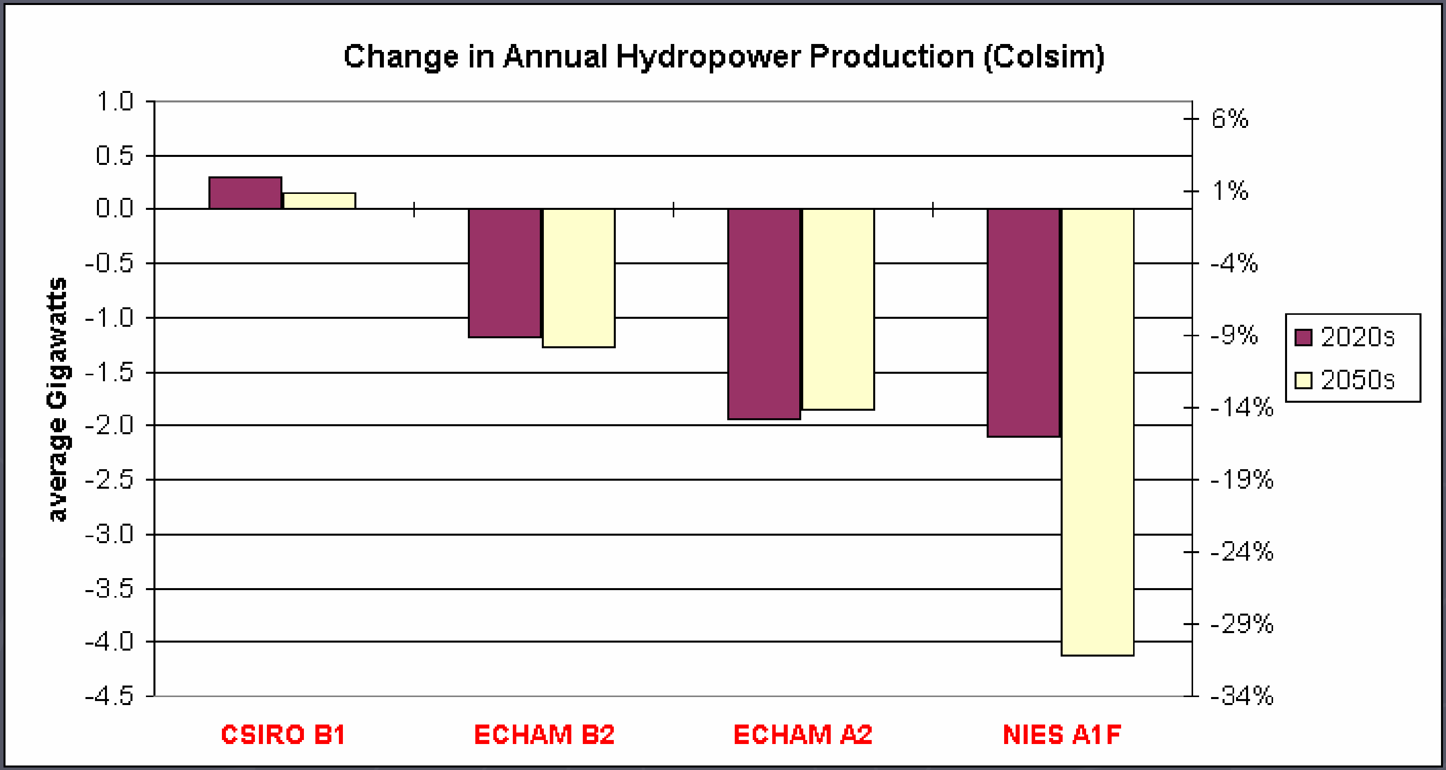


Quantifiable range of uncertainty delineated by model results (M1 to M4), lying within the total range of uncertainty that can't be fully quantified. (Figure taken from Jones, 2000)

Series of models used to predict impacts



IPCC TAR (2001) Scenarios



Change in average annual hydropower production, as simulated by VIC/ColSim, in average Gigawatts for the 2020s and 2050s. The right axis is percent of simulated baseline hydropower production.

Of the 2001 scenarios, CSIRO and NIES are the “best” and “worst” case, respectively.

- Each scenario is prediction of the long term trend over which natural variability is superimposed

- All scenarios show a shift in streamflow timing – this change in the regional hydrograph should be expected with very high likelihood

- These scenarios also show significant likelihood that total streamflow (and thus hydropower potential) will diminish

Linear regression model can reliably predict VIC/Colsim output

Dependent Variable: Corrected average annual VIC flows at The Dalles

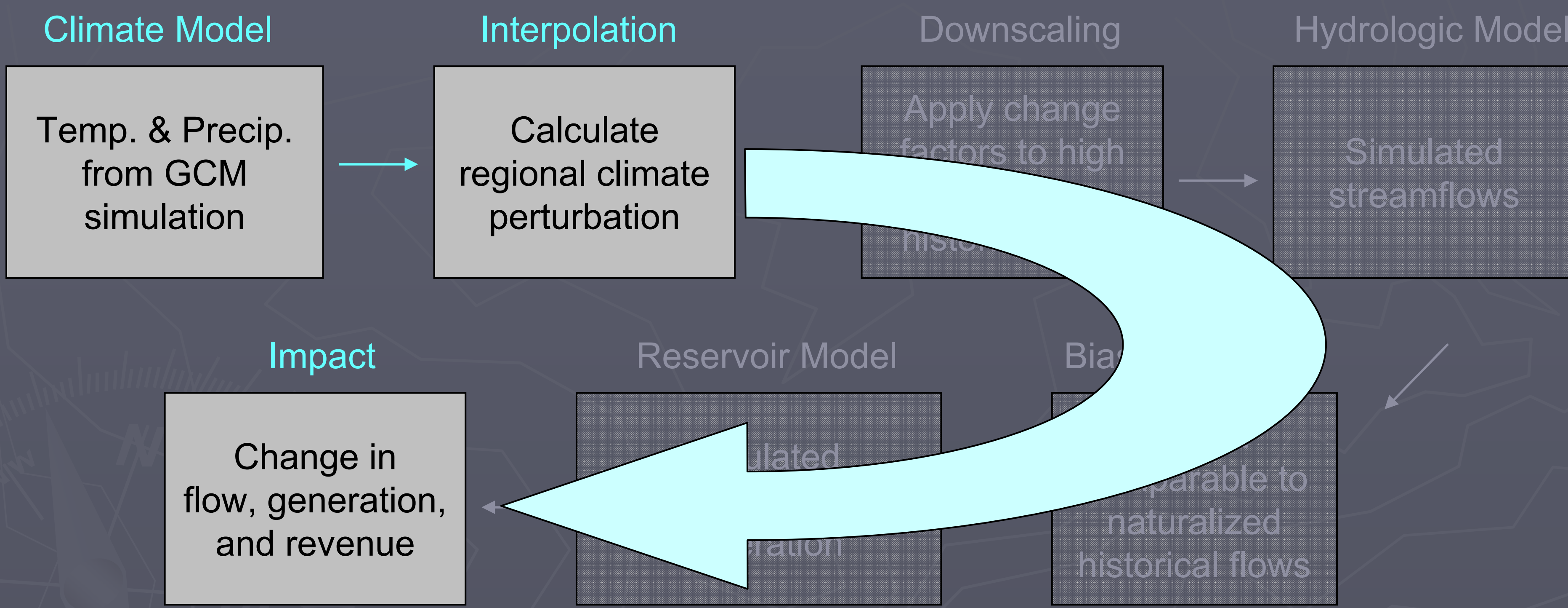
Predictive Variables	Standardized Coefficients
Winter Precipitation △	0.45**
Summer Precipitation △	0.31**
Winter Temperature △	0.54 *
Summer Temperature △	-0.86**

Adjusted R Square: .97

* = significant at the p < .05 level

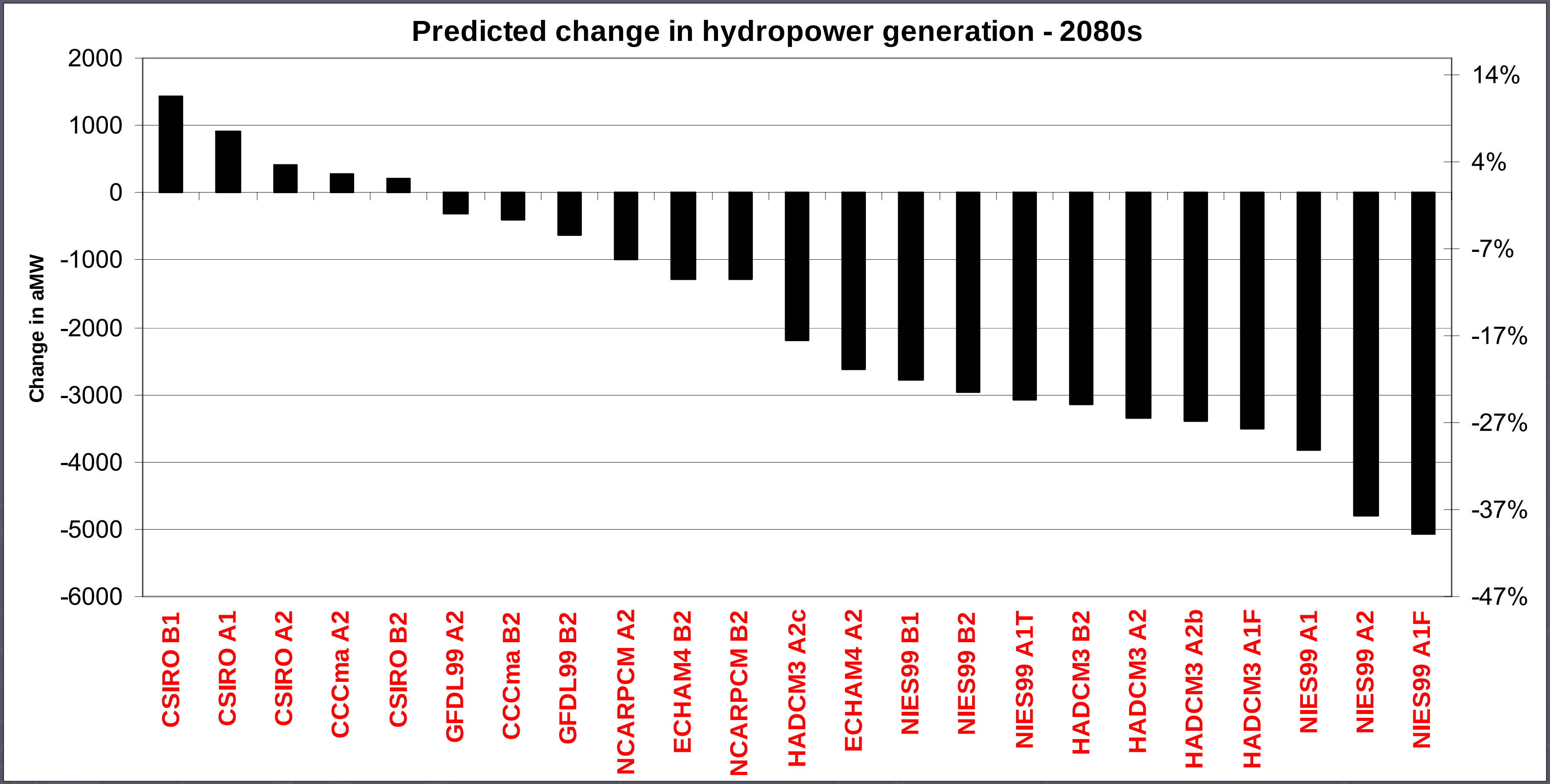
** = significant at the p < .01 level

Simplified impact prediction



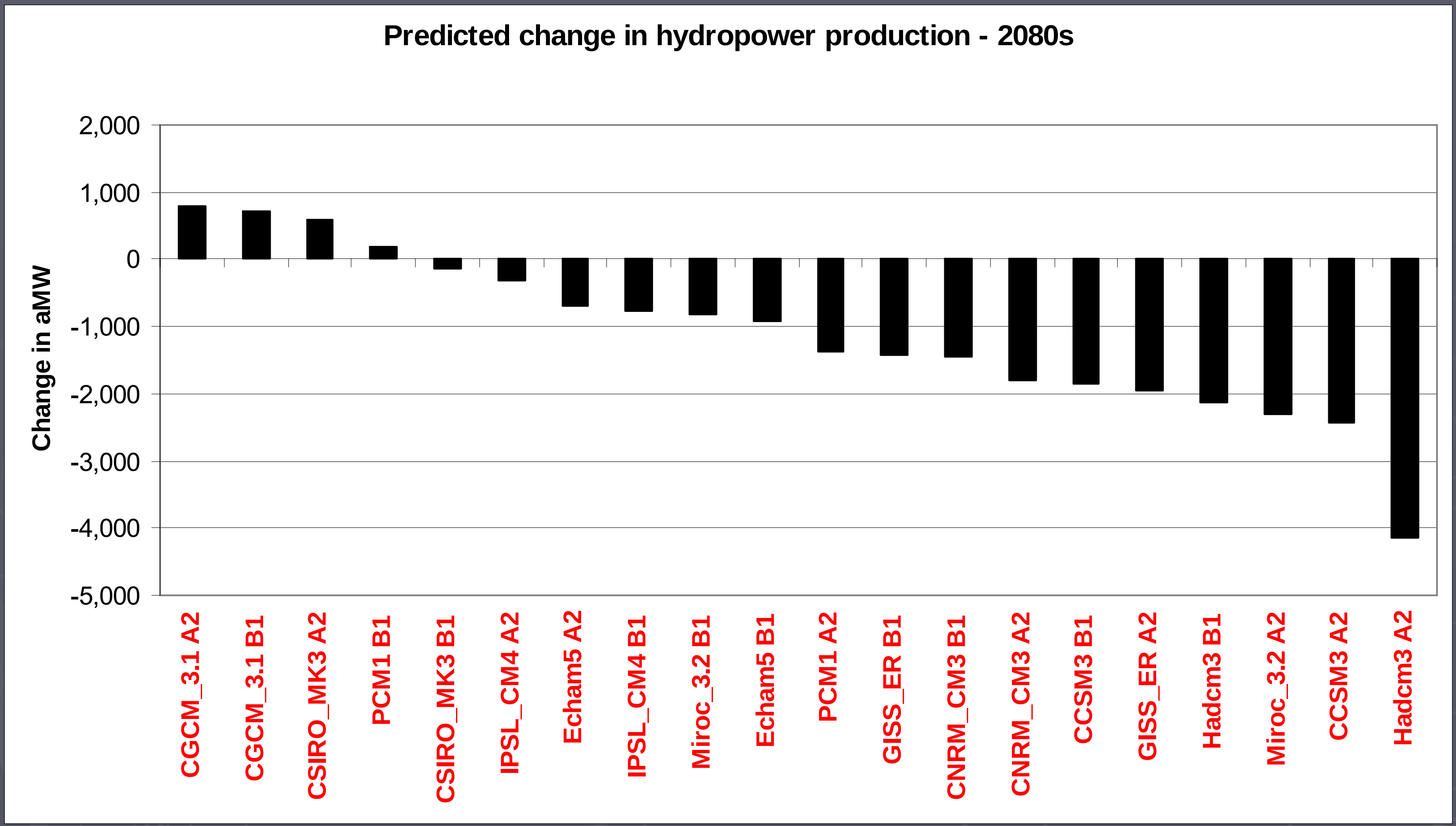
- Allows for quick, if crude, assessment of wider range of climate scenarios

All TAR scenarios



Predicted change in annual aMW, using the regression equation for all model and scenario combinations in 2080s. The right axis shows percent of estimated baseline hydropower production.

Applied to the IPCC AR4 (2006) scenarios from the CIG...



Less severe than the TAR scenarios, but still could be taken to imply:

- 80% chance that the hydropower resource will be diminished
- 50% chance that more than 1,000 aMW will be lost

- Planning under uncertainty remains order of the day, adaptation strategies must be robust
- Temptation to average all scenarios together should be resisted
- Full cost of climate change to PNW water resources should include impact to other management objectives such as flood control and instream flows for fish
- More study is needed, but the risk of not beginning adaptive action in the meantime is clear

Questions?

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